University of Kansas

Some students, seniors who are now attending University of Kansas, were funded by the group's NSF base grant.

CMS Data Analysis

E. Gibson, E. Smith
P. Baringer (University of Kansas)
O. Strawderman (Lawrence Free State High School)

This summer we used ROOT to create histograms from the data of simulated 7 TeV proton-proton collisions. We focused on two specific interactions: the TTbar and TW decay paths. The TTBar interaction is caused by the strong nuclear force, and the TW by the weak nuclear force. Despite their differences, the only distinguishing factor between the two paths is one b-jet. To find a way to tell the difference, we graphed variables from each data set, the TTbar and TW, to look for differences in the histograms. This graphed data can be further compared with future 8 TeV data to look for more significant changes in the data between these two interactions. The next step in this analysis is to graph 8 TeV data, and compare those results to the results from the 7 TeV data. This could lead to further insights about the nature of these two interactions, and the forces behind them.

Quarked! Outreach Program

D. Conway P. Shields
P. Baringer (University of Kansas)
O. Strawderman (Lawrence Free State High School)

We worked with the Quarked! Program, a program designed to introduce particle physics to children ages seven to twelve. Specifically, we used Flash to design games that were based on particle physics concepts. Creating a game involves researching the physics we wish to incorporate, designing the layout of the game, and using ActionScript 3 to create the interactive parts of the game. At this point we send the game off to people who test the games and provide us with feedback about appearance, ease to use, and any errors that occurred while they were playing. This part is repeated several times. Patrick produced a word search of physics terms, and is working on improving a Baryon Blaster game that was already on the website. Dawson created a crossword of physics terms designed to run on Android devices. He then added a version of it to the two existing web-based crosswords and added versions of the web-based crosswords to the Android app. These are all going to be available to the public in the near future.

Cosmic Ray Detectors

A. Dietz, A. Souvannakhot, S. Srisutiva
D. Besson (University of Kansas)
O. Strawderman (Lawrence Free State High School)

During QuarkNet, we worked with already built cosmic ray detectors. After testing them for light leaks, we covered them in another layer of electrical tape until they were light tight and usable. We then plateaued the detectors so that they were only collecting data from cosmic rays. We set the paddles of the detector to detect coincidence so that we could run performance and displacement studies. After running a performance study and blessing our data on the Cosmic Ray e-Lab, we collected and uploaded several days' worth of data. Hooking up the paddles of the detector to a NIM system, we ran a displacement study examining the difference in coincidence based on the zenith angle. In the meantime, we learned how to calibrate an antenna and network analyzer so that we could find the connection between Cherenkov radiation and cosmic ray hits. We connected the NIM setup, cosmic ray paddles (set to four-fold coincidence) and an oscilloscope (which is connected to the antenna), and used a code that collected data from the antenna each time we received a four-fold coincidence on the scintillators to find this relationship.

Death Ray Antennas

C. Bandle, E. Crandon
D. Besson (University of Kansas)
O. Strawderman (Free State High School)

The purpose of our project was to build antennas that could detect 25 Mhz–300 Mhz frequencies and then trigger in-ice antennas at the South Pole. This was all done for neutrino research. We built several trial antennas before finally deciding on the death ray antenna, which used copper pipes and a wooden frame. We spent most of our summer building these antennas through cutting pipe and soldering pieces together. After building our first of eight antennas, we tested the SWR with the network analyzer. We elevated the antenna in a tree to eliminate outside/standing waves. We found that our antennas gave pretty good data, and we are continuing with the seven we have left to build. Based on our results from the first antenna, they are good enough to send to the South Pole by the beginning of September. They will be put one meter into the ground by December to begin testing by January.

Developing a Method for Surface Wave Detection|

A. Johannesen, A. Zheng
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O. Strawderman (Free State High School)

It is theoretically possible to improve current methods of ultra-high-energy neutrino (>1020 eV) detection by observing askaryan radiation via dielectric-dielectric surface waves rather than bulk waves. The purpose of our research was to observe properties of these surface waves within the paradigm of neutrino detection. Observations were made of waves propagating through various dense dielectric mediums including granulated fused silica, polystyrene foam, deionized water, and granulated sodium chloride at preliminary frequencies of 1500, 1000, and 750 MHz. Larger-scale granulated fused silica measurements were taken at the frequencies of 600 and 300 MHz. Antenna properties measured include the standing wave ratio and complex impedance; surface layer properties measured include attenuation length and wavelength, from which was calculated substance phase velocity and refractive index. A qualitative increase in attenuation length was found for waves propagating along a dielectric-dielectric surface rather than exclusively in either dielectric substance. Further steps include using a substantially lower frequency: in the order of 104 Hz, which implies a significant antenna and measurement scale increase. Additional changes necessarily include observations in the context of ice; a shift in region may be required.